SD11
A5A55
49

FOREST SERVICE
ROCKY MOUNTAIN FOREST & RANGE EXP. STATION
FORT COLLINS, COLORADO
JAN 14 1942
RECEIVED

U. S. DEPARTMENT OF AGRICULTURE

Forest Service

APPALACHIAN FOREST EXPERIMENT STATION

Technical Note No. 49

Asheville, N. C.
December 15, 1941.

SMOKER FIRES AND FIRE BRANDS

By

John J. Keetch

Smokers are reported, on a 5-year average,[1] to start one-fourth of the nation's forest fires. If this figure is reasonably accurate --many foresters question the reliability of the data--then much of our fire prevention effort should properly be directed toward the elimination of smoker fires. At a meeting of fire men held in Elkins, West Virginia, August 1940, the problem of smoker fires was the subject of much discussion. This resulted in the decision that the Appalachian Forest Experiment Station would review and summarize all past fire brand and ignition studies to see what contribution these data could make to a knowledge of the smoker fire problem. The purpose of this technical note is to present the results of this review. In addition to the eleven published reports listed, source of material includes unpublished data.[2]

Attention has been focused on the smoker fire because there is some question as to the seriousness of the smoker fire problem. Fire control leaders are considering whether this is a REAL problem after all, or if the statistics are undependable. They are aware that unreliable statistics result in misdirected fire prevention effort, and that it is futile to attempt an analysis of HOW to direct fire prevention effort when there is insufficient evidence to indicate WHERE it should be aimed.

---

[1] U. S. Department of Agriculture, Forest Service, Washington, D. C. Forest fire statistics for the calendar year 1940.

[2] Grateful acknowledgment is made to the following agencies for supplying unpublished material used in this survey: (1) California Forest and Range Experiment Station, (2) Pacific Northwest Forest and Range Experiment Station, and (3) Southern Forest Experiment Station.

LIBRARY COPY
ROCKY MT. FOREST & RANGE
EXPERIMENT STATION

Several controversial questions arise in the minds of fire control leaders whenever the smoker fire problem is considered:

1. Which of the smoking materials, match or cigarette, starts more of the fires, and how do they compare with other fire brands?

2. What fuel moisture and wind conditions define the ignition range of smoker fire brands?

3. On some ranger districts more than 80 percent of the fires attributed to smokers are admittedly 50 to 100 percent guesses--how can this proportion of guesses be reduced?

The results of the summary provide a reasonable answer to question one. The data from the survey do not answer adequately the second question because the divergence of testing methods makes it difficult to draw conclusions on a comparable basis. However, several investigators agree very closely on the critical fuel moisture and wind conditions, and these are worth considering.

SUMMARY OF RESULTS FROM IGNITION TESTS

The Relative Importance of Various Fire Brands as Ignition Agents

The concensus of experiments indicates that fire brands are effective in the following order, with the most effective agent first:

1. Broadcast slash pile burning.
2. Large bonfires or burning slash piles.
3. Small campfires.
4. Burning matches (kitchen stick variety).
5. Lighted safety and book matches.
6. Pipe heels.
7. Locomotive sparks and glowing embers.
8. Fast-burning cigarettes.
9. Lighted cigars.

The relative position of matches on this list indicates that the specific causative agent of nearly all smoker fires is probably the match. This answers question one, and is supporting evidence that the major smoker prevention effort should be directed against matches.

The Effect of Fuel Density, Fuel Moisture and Wind

The investigators placed little importance on the factor of fuel density although some tests indicated that dense fuels ignite more readily than loose fuels, other things being equal. This trend might well be investigated further because the compactness of fuels in eastern hardwood types varies considerably from one season to another. Such information might be useful in connection with question two.

In general, the tests indicated that burning matches seldom start fires when surface fuel moisture exceeds 15 percent. This is a specific fact that rangers should be able to use as a guide in judging the cause of a questionable fire--helpful in answering question three.

The tests revealed that wind has a varying effect dependent on the fire brand. Cigarettes rarely cause ignition in the absence of wind, but start a smouldering area that requires a breeze to fan it into flame. Matches are not affected by winds up to four miles per hour, but winds exceeding four miles per hour usually will extinguish the match. These data on fuel moisture and wind provide a partial answer to question two. It is well known, of course, that wind has a very marked effect on the behavior of a fire once it is started.

The Relative Importance of Various Fuels

Tests with fire brands have been inadequate, as far as could be determined in this analysis, to establish definitely the susceptibility of each fuel to ignition. Considerable evidence, however, indicates that matches and cigarettes are effective on major fuels as follows, in decreasing order: for matches, (1) pure coniferous duff, (2) coniferous-hardwood mixture, (3) hardwood litter, and (4) rotten wood; for cigarettes, (1) rotten wood and (2) other fuels.

CONCLUSION

The tests indicate, as fire men have long suspected, that the ignition range of pipe heels, cigarettes, and cigars is well below that of matches, and that, in general, the critical ignition range with matches can be used as a criterion of possible smoker fire origin. When fuel moisture is more than 15 percent, or wind velocity more than four miles per hour, regardless of fuel moisture, the fire investigator is justified in considering incendiarism since the ignition studies support the conclusion that carelessly tossed matches are rarely effective under these conditions. These data are partial answers to question two, but further investigation is needed to provide more exact information that can be used effectively in reducing the proportion of guesses in smoker fire classification.

PUBLISHED MATERIAL USED IN THE FIRE BRAND STUDY

1. SALE, P. D., AND HOFFHEINS, F. M. (U. S. Bureau of Standards)
   1928. Cigarettes and cigars, fire hazard tests. Reprint from January quarterly of National Fire Protection Assoc.

2. HOFFHEINS, F. M. (U. S. Bureau of Standards)
   1933. Fire hazard tests with cigarettes. Reprint from October quarterly of National Fire Protection Assoc.

3. LARSEN, J. A., AND DELAVAN, C. C.
   1922. Climate and forest fires in Montana and northern Idaho, 1909 to 1919. Monthly Weather Review. Feb. p. 66.

4. SHOW, S. B.
   1919. Climate and forest fires in northern California. Jour. Forestry. Vol. 17 (8) Dec. p. 965-966.

5. GISBORNE, H. T.
   1928. Measuring forest fire danger in northern Idaho. U. S. Dept. Agr. Misc. Pub. 29. Oct. p. 13-15.

6. STICKEL, PAUL W.
   1931. The measurement and interpretation of forest fire weather in the western Adirondacks. New York State College of Forestry Bul. Tech. Pub. 34. Dec. p. 21-34.

7. ———
   1932. The role of silviculture in forest fire control. Manuscript dated Aug. 31, 1932. New Haven, Conn. p. 3-6.

8. NICHOLS, L. H.
   1929. Second report to the Quebec Forest Industries Assoc., Ltd., on meteorological and forest fire hazard conditions in the Province of Quebec. Oct.

9. ———
   1930. Third report to the Quebec Forest Industries Assoc., Ltd., on meteorological and forest fire hazard conditions in the Province of Quebec. Nov.

10. ———
   1931. Fourth report to the Quebec Forest Industries Assoc., Ltd., on the burning of settler's slash and meteorological conditions in the Province of Quebec during 1931. Nov.

11. WRIGHT, J. G.
   1932. Forest fire hazard research as developed and conducted at the Petawawa Forest Experiment Station. Dept. of Interior, Division of Forest Protection, Ottawa, Canada.